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AIR LEAKAGE IN EXISTING TOWN HOUSES

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INTRODUCTION

Air leakage through walls and roofs is a major contributor to space heating requirements in housing. An initial comparison of air tightness between single-detached dwellings and town houses indicated that the latter were significantly leakier. This study of air leakage in existing town houses was undertaken to determine:

i) air tightness of town house envelopes compared with single-detached dwelling envelopes;

ii) major air leakage routes through town house envelopes; and

iii) the effect of construction details and workmanship on air leakage through town house envelopes.

TESTING PROGRAM

More than thirty town houses were tested for this survey. All town houses were located in Calgary, Alberta and they were selected from eight different town house developments. Nine units were constructed prior to 1975, nine units were built between 1975 and 1982 and the other units were built after 1982.

Air tightness of the building envelope was measured by the fan depressurization method. This method is widely used and is required for certification of R2000 dwellings. This method uses a powerful fan to draw air out of the dwelling. The air flow rate through the fan nozzle is measured at various differential pressure levels inside the house and outside. At a differential pressure of 50 pascals, the air change rate of the house is determined and this provides a measure of the tightness of the envelope. In the case of town houses, the procedure is more complicated than for single dwellings because of a requirement to negate the contribution of air leakage between the test unit and adjacent units during the test. For this reason units on either side of the test unit are depressurized simultaneously.

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Detailed testing was carried out on one town house to quantify air leakage through various portions of the building envelope. Accessible leaks were sequentially sealed using caulking and sealing techniques promoted by energy conservation agencies and the dwelling was re-tested numerous times.

FINDINGS

Table 1 summarizes the air change per hour of town houses at a negative pressure of 50 pascals (AC 50).

	Interior Units								End Units		
Date Built	Adjacent Units Unequalized		1 of 2 Walls Equalized			Both Walls Equalized			Adjacent Units Equalized		
	Sample Size	AC50	Sample Size	Drop in AC50		Sample Size	Drop in AC50		Sample Size	Drop in AC50	
pre-75	9	5.2	3	1.5	26%	0	-	-	3	1.1	23%
75-82	9	7.8	1	1.7	19%	2	3.7	61%	1	2.6	30%
82+	16	5.2	4	0.9	23%	5	2.6	38%	3	1.7	31%
all	34	5.9	8	1.2	24%	7	2.6	45%	7	1.6	27%
standard deviation		4.1									

Note: The drop in air change is relative to the air change with the adjacent units unequalized. The overall percentage drop is the average of the 3 age group figures weighted by sample size.

Table 1: Summary of Statistics of Town House Air Leakage (AC 50)

The results of sequentially sealing major accessible air leakage routes are summarized in Table 2.

Sealing Stage	Air Changes @ 50 Pa	Equivalent Leakage Area (m2)	Normalized Leakage Area	Relative Tightness
31 baseline unequalized	5.4*	0.079	5.3*	1.3*
30/32 pty. wall elec. outlets	5.5	0.070	6.5	1.6
31 party wall elec. outlets	5.5	0.080	6.5	1.6
31 basement pty. wall leaks	4.9	0.075	5.8	1.4
31 interior partition gaps	4.8	0.070	5.5	1.3
31 exterior wall elec. outlets	4.9	0.067	5.2	1.3
31 windows	4.6	0.061	4.7	1.2
31 ceiling (attic side)	4.4	0.064	5.0	1.2

* These numbers are suspect, given that the next test resulted in higher values although minor air-tightening had been undertaken; the second set of numbers are likely more representative.

Table 2: Summary of Results of Sequentially Sealing Major, Accessible Air Leakage Routes

CONCLUSIONS AND RECOMMENDATIONS

Envelopes of town houses were found to be leakier than those of single family dwellings. Party walls were found to be major contributors to air leakage. While this is not a problem in terms of energy conservation, even small penetrations substantially increase noise transmission between dwellings. Air transfer between dwellings also results in air quality problems, as when cigarette smoke migrates to the dwellings of non-smokers. The degree of party wall leakage identified also indicates the need for developing testing methods that better differentiate this leakage from outdoor leakage.

The sequential sealing of leakage routes which attacked accessible apertures in the envelope, only eliminated a minor portion of overall leakage. Further work needs to be done to determine whether leakage through the party wall up to attic spaces is the cause of poorer performance, or whether workmanship or other factors are the primary cause.